Short Communications

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Conspecific Collisions Can Precipitate Mortality in Migrating Eared Grebes

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ABSTRACT.—Collisions between flying birds are a negligible problem for most species, but they may be a regular hazard for Eared Grebes (*Podiceps nigricollis)* in migration. This is a consequence of many aspects of the grebes' biology, including their massing at staging areas, early winter migrations, nocturnal movements, and poor agility in flight. *Received 13 January 1998, accepted 3 May 1998.*

Mono Lake, California, and Great Salt Lake, Utah, are the major staging areas for Eared Grebes (*Podiceps nigricollis)* in North America. Hundreds of thousands congregate there through the fall, remain until food runs out, and then fly at night to wintering grounds in southern California and Mexico (Jehl 1988). During these flights, large numbers of migrants sometimes crash and die after they lose their bearings in snow or fog (Jehl 1996). Mortality ensues from the trauma they suffer on impact with the ground or other fixed objects. In some cases the stage for mortality, if not actual death, may be set a few moments earlier, when migrants collide with each other in flight.

On the night of 13–14 January 1997, thousands of grebes migrating southward from Great Salt Lake flew into a snowstorm and crashed in southern Utah. Near the town of Delta about 3650 hit the ground after being attracted to lights of houses; of these 148 (4.1%) were found dead. Concurrently, 8 km away, 3600 more were downed and 1600 (44.4%) were found dead in a 2-ha pond at the Intermountain Power Project plant (IPP). Internal examination of over 1000 carcasses showed, as in previous downings (Jehl 1993), that death resulted from severe trauma (e.g., massive internal bleeding; broken bill, sternum, clavicles, legs; cranial hemorrhage; ruptured spleen or liver).

Weather-related downings of grebes are not infrequent in this area (Jehl 1996), but one aspect of the 1997 events was unusual: mortality was ten times greater at the IPP ponds than at Delta. This is counterintuitive, because even a hard landing on a pond is more survivable than flying into frozen ground. Migrants at IPP must have perceived the ponds correctly—as an oasis of open water in the Utah desert in winter—or they would not have been concentrated there.

Why the extreme difference? I suggest that the high mortality at IPP can be traced to traffic congestion, which resulted when thousands of migrants disoriented by the snowstorm homed in on the brilliant lights of the plant which can be seen for miles. In circling over the ponds while trying to land, and probably further confused by the blinding lights, many crashed together and fell to earth. Grebes at Delta were attracted by the lights of a town, but these were much dimmer in comparison. Because there were no lighted ponds at Delta to concentrate migrants, collisions were rare or lacking and the mortality rate was lower.

The notion that collisions could be a cause of mortality prompted me to re-examine several puzzling, but similar, instances among grebes staging at Mono Lake (Jehl 1988, unpubl. data). All involved carcasses found on beached-bird surveys late in the staging period: 11 November 1984 (378 birds), 28 October 1986 (43), 25 November 1994 (>600), 18 November 1996 (≈60) and 19 November 1997 (50–100). Mortality took place during the peak of the emigration period. Nearly all the birds died shortly (in most cases 1–4 days) before being discovered. All were in full migratory condition, having completed the changes in body compositon that are necessary for them to reacquire flight after hav-

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ing been flightless for a long period (Jehl 1997). Externally, they seemed to be in good shape; they were fat (mean body mass ranged from 417–442 g in the several samples) and carried enough fuel to migrate successfully to the wintering areas (Jehl 1994). Yet, most were bleeding from the mouth and some had broken bills or wings. Subsequent internal examinations (no data from 1996) revealed the same signs of extreme trauma seen in birds downed in migration. Death from trauma in 1994 was confirmed by veterinarians from the National Wildlife Health Center (L. Glaser, pers. comm.).

What caused this mortality? There is no possibility that these grebes died or sustained injuries while staging on the lake, that the injuries resulted from shooting or the secondary actions of scavengers (coyotes, *Canis latrans;* Common Ravens, *Corvus corax),* or that internal bleeding was the result of some hemorrhagic disease. None of these explain the broken bones and the timing of mortality coming at the peak of migration. The physiological condition of the birds showed that they were capable of flight. The shoreline location of the carcasses indicated that grebes died when flying over the lake. Yet, in no year was there any indication of bad weather (snow, fog, severe downdrafts) that might have caused the birds to become disoriented or to have forced them back to earth. I infer that the birds collided with other grebes as they rushed to leave the lake shortly after sunset. Most collisions must have occurred within moments of take-off because it would require no more than 10 minutes for a for a grebe to fly beyond the boundaries of the lake.

DISCUSSION

Collisions in flight are so rarely discerned (e.g., Abraham and Wilson 1997) that the possibility that they might result, directly or indirectly, in significant mortality may be hard to accept, especially by anyone who has marvelled at the intricate maneuvers of tightly-flocked shorebirds. Yet, many aspects of Eared Grebe biology interact to increase the risk of collision as birds leave staging areas.

1. Grebes stage in huge numbers; the fall flock at Mono Lake exceeds 1.5 million birds (Boyd and Jehl 1998).

2. Prior to leaving staging lakes grebes often congregate in tight flocks and their distribution on the lake is often highly clumped (Jehl 1988).

3. They migrate at night when visibility is poor.

4. They migrate in flocks. Their pre-emigration practice flights can evoke contagious behavior, which suggests that many groups are stimulated to take flight at about the same time.

5. The duration of the main emigration period is probably 2–3 weeks (Jehl 1988, unpubl. data), which means that an average of 75,000–100,000 birds leaves Mono Lake nightly. Because weather conditions cannot be assumed to be uniformly favorable in this peroid, there are surely many nights when the emigration is far larger.

6. Departures are concentrated with an hour or so after dark (Jehl 1997, unpubl. data).

7. Grebes are poor fliers, and departing migrants are heavily wing-loaded (Jehl 1994). It may also be relevant that most have not flown for weeks, if not months (Jehl 1988).

These factors suggest that collisions among departing grebes are likely to be regular, and even predictable hazards, to birds departing staging areas and need to be considered when evaluating the cause(s) of late-season mortality. Collisions can also affect migrants that have departed safely but which later become disoriented and swarm around lights. The problem is compounded by the poor maneuverability of flying grebes, whose lack of a tail makes it impossible for them to fly very slowly, turn quickly (Thomas 1997), or avoid obstacles detected at the last minute.

The risk of collisions raises several questions about grebe behavior and aerodynamics. For example: grebes fly in flocks, but unlike most nocturnal migrants are not known to call during flight; how, then, do they maintain flock integrity without colliding? Grebes cannot take off without first achieving forward momentum (from running on water). Do collisions cause them to lose momentum and plummet to earth? This seems probable because migrants are heavily wing-loaded, and because grebes cannot glide they cannot regain flight stability. Most of the collisions inferred above would have occurred at low elevations, perhaps ranging from a few meters (Mono Lake) to several hundred meters (Utah). From what height would an uncontrolled fall result in mortal trauma? Is there any height from which a falling grebe might be able resume flying if it had lost all forward momentum? Further observations and experiments will be instructive.

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Observations of Geese Foraging for Clam Shells During Spring on the Yukon-Kuskokwim Delta, Alaska

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ABSTRACT.—We studied the behavior of geese on exposed river ice during spring on the Yukon-Kuskokwim Delta. The predominant behavior while on the ice for both sexes was foraging; however, females foraged more than males. Visual inspection of the ice revealed no potential plant or animal food items. However, numerous small (<20 mm) clam shells (*Macoma balthica*) and pieces of shell were noted. It appeared that geese were foraging on empty clam shells. This potential source of calcium was available to breeding geese just prior to egg formation and geese likely stored this calcium in the form of medullary bone for use during egg formation. *Received 9 Sept. 1997, accepted 8 March 1998.*

Arctic nesting geese produce eggs from endogenous reserves (e.g., protein, lipid, and minerals) stored prior to the initiation of egg laying (Ankney and MacInnes 1978). Mineral reserves, particularly calcium, are deposited in the form of labile medullary bone (Simkiss 1967). Females build calcium depots prior to breeding and utilize this reserve when calcium demands for egg shell production exceed dietary intake (Krapu and Reinecke 1992). However, calcium is not always readily available for pre-breeding consumption and this limitation in medullary bone production may be an important factor influencing clutch size in some waterfowl species (Alisauskas and Ankney 1994).

The Yukon-Kuskokwim Delta supports large numbers of breeding Emperor Geese (*Chen canagica*), Cackling Canada Geese (*Branta canadensis minima*), Black Brant (*Branta bernicla nigricans*), and Greater White-fronted Geese (*Anser albifrons*) (Mickelson 1975). All 4 species arrive between late April and early May and begin nesting 1–3

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